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Phytogeographical notes on the Rocky Mountain region
VIII. Distribution of the Montane plants

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The Montane Zone or Pine Belt of the Rocky Mountain region includes approximately the areas between the altitudes of 2,500 and 3,000 m. in southern Colorado, between 1,800 and 2,500 m. in southern Montana, and between 1,200 and 1,800 m. in Alberta, where the Canadian Pacific Railroad crosses the mountains. A general description of the Zone has been given in a previous article.*

The Subalpine Zone of the Rockies comes in contact with the Hudsonian or Eastern Subarctic Zone along the foothills of the Rockies from the headwaters of the Peace River northward, and here the species of the East and of the Rockies more or less intermingle. But the relation between the Montane Zone of the Rockies and the Canadian or Eastern Boreal Zone is very different, for the latter, in its typical development, reaches its western limits in the region of the Lake of the Woods and Lake Winnipeg. The most representative species of the Canadian Zone, *Strobus* and *Pinus resinosa*, reach their northwestern limits in this region and it is only in the transition belt between the Canadian and Hudsonian Zones, which extends along the height of land between the Saskatchewan and Athabasca Rivers, that species of the Canadian Zone range farther west. This transition belt is characterized by mixed woods of *Pinus Banksiana*, belonging to the Canadian, and of spruces and larches belonging to the Hudsonian Zone. North of the upper Athabasca River and Beaver River practically the whole country is Hudsonian, while south of the northern branch of the Saskatchewan the prairies and the plains begin. These latter grassland formations belong to the Transition or Sub-boreal Zone.

The number of plants common to the Canadian Zone of the East and the Montane Zone of the Rockies is small, outside of

* See Bull. Torrey Club 42: 11-25. 1915.

the common transcontinental species that grow along the water-courses and species which are common to the Hudsonian-Subalpine Zone and the Canadian-Montane Zone. None of the conifers are common to the two regions, and among the trees which occur in common we find only a few species of *Salix*, *Populus*, and *Betula*. If we consider the relationship between the Montane plants of the Rockies and those of the Pacific Coast Mountains, however, we find the conditions quite different. The Cascade Mountains are directly connected with the Rockies in the north and there are several mountain chains interposed between the Cascades and the Rockies in British Columbia, separated from one another only by narrow river-valleys. The Montane Zone of the Cascades, therefore, is practically continuous with that of the Rocky Mountains, and the two regions have many plants in common, the leading conifers not excluded. Many of the Pacific species have emigrated into the Rocky Mountains, especially into the northern Rockies, and many Rocky Mountain species into the Cascades.

As has already been pointed out in earlier articles of mine, the Rockies may be divided into two principal parts, the Northern Rockies, extending from the Yukon Territory to northern Wyoming, and the Southern Rockies, of southern Wyoming, Colorado and northern New Mexico. Each of these main divisions may be subdivided, and the following districts may be distinguished:

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|--------------------------------|-----------------------------|
| <i>Northern Rockies</i> | 7. Big Horn District |
| 1. Canadian Rockies | 8. Black Hills District |
| 2. Main Range, Montana | <i>Southern Rockies</i> |
| 3. Selkirk-Bitterroot District | 9. Main Range District |
| 4. Belt Mountains District | 10. Uintah-Wasatch District |
| 5. Yellowstone District | 11. Sevier District |
| 6. Sawtooth District | 12. La Sal-Abajo District |

The main range of the Northern Rockies north of Butte, Montana, is rather homogeneous and the change in the Montane flora seen in proceeding northward is rather gradual, although many of the high northern species found in the Canadian Rockies (District 1) are not found in Montana.

South of Butte the main range (District 2) becomes lower and less distinctly Montane until the neighborhood of Yellowstone Park is reached. Here it rises higher and the Alpine Zone is present in the Bear Tooth, Shoshone, Teton, Gros Ventre, and

Wind River Ranges. This region may be regarded as a distinct subdivision (District 5).

Numerous species belonging to the Cascade Mountains have invaded the Selkirk Mountains in British Columbia and the Bitterroot Mountains between Idaho and Montana, and the flora here has become more or less Pacific in its character. This region (District 3) includes also more or less the western slopes of the main range in British Columbia and northern Montana.

The mountains of Central Idaho, such as the Sawtooth, Salmon River, and other ranges (District 6) are characterized in the Montane Zone rather by the lack of many species found in the main range than by the introduction of any considerable new element. In the Submontane Zone, however, the character of the flora apparently is more like that of the mountains of the Great Basin than that of the main range, although the flora of this region is not so well known as might be desired.

The isolated mountains of central Montana, such as the Belt Mountains, the Snowy Mountains, the Crazy Mountains, and the Little Rocky Mountains, together with the Cypress Hills in Canada (District 4), being rather low, are characterized by a meagre Montane flora without any additional element. This can also be said of the Big Horn Mountains of Wyoming (District 7), although these are much higher and contain a few strictly endemic species.

The Black Hills of South Dakota and Wyoming are also to be counted as a subdivision of the Northern Rockies (District 8), although they contain quite a number of species belonging to the Southern Rockies as well as many belonging to the Canadian and Alleghanian Zones.

In the Southern Rockies the main range (District 9) includes all of the mountains in Colorado and northern New Mexico, together with the Sierra Madre, Medicine Bow, and Laramie Ranges in Wyoming. Only a few peaks of the latter reach the Montane Zone.

The Uintah and the northern part of the Wasatch Mountains in Utah (District 10), although geologically belonging to the Northern Rockies, have a flora closely resembling that of the Southern Rockies. In the Wasatch Mountains, however, there

are found quite a number of species which have immigrated from the Northern Rockies or from the mountains of the Great Basin. The southern part of the Wasatch Mountains, including the Sevier Range, the Henry Mountains, and other ranges west of the Colorado of the West (District 11), have a flora characteristic of the Basin Mountains. The Montane flora consists to a great extent of species common to the Rockies, the Basin Mountains, and the Sierra Nevada. The La Sal and Abajo Mountains, in Southeastern Utah (District 12) have a mountain flora almost the same as that characteristic of the main range of the Southern Rockies in Colorado.

The plants of the Montane Zone of the Rocky Mountains may be classified in the following categories. These are practically the same as those in the Subalpine Zone, with, however, some modification.

- I. Transcontinental Species.
- II. Species common to the Rockies and the Canadian Zone of the East.
- III. Species common to the Rockies and the Pacific Mountains.
- IV. Endemic species.

I. Transcontinental Species

The transcontinental species, as well as most of those common to the Rockies and to the East, consist partly of forest species, most of which have migrated around the Saskatchewan Plains, partly of water, meadow, and thicket species which have followed the watercourses across the plains. The former consist to a great extent of species common to the Subalpine and Montane Zones in the Rockies and hence also to the Hudsonian and Canadian Zones of the East; the latter consist mostly of species found also in the Submontane and Transition (or Alleghanian) Zones. Many of the water and bog plants, however, are not found on the plains and hence must have followed the woods.

A. TRANSCONTINENTAL SPECIES RANGING THROUGHOUT THE ROCKIES

Here I have included species which are found in the main ranges of both the Northern and Southern Rockies. Many of

these may be lacking in one or more of the districts or subdivisions, especially in Districts 8, 11, and 12, but some also in Districts 4, 6, and 7.

I. PLANTS WITH BOREAL-SYLVAN DISTRIBUTION

In this discussion the word "sylvan" applied to a plant does not mean that it grows only in the deep woods, but that its distribution has taken place in connection with the Northern Woods, and that it does not grow in the prairie or plains regions. The plant may be a forest species in the true sense or it may grow in open woods, thickets, or among rocks in more open places. The essential point is that its migration east or west has taken place around and north of the plains, and not across them along the water-courses. To this category belong the transcontinental trees and most of the shrubs. The most important of the former is the quaking aspen, *Populus tremuloides*, also found in the Subalpine Zone.

In this and subsequent lists, species which are marked "*" are rare in the Southern Rockies; those marked "†" attain their best development at higher altitudes and reach the Alpine zone; those marked "‡" develop best lower down and reach the plains; those followed by "(Eur.)" are found also in Europe and usually also in northern Asia. The nomenclature is that of the author's Flora.*

a. Forest species

Trees

<i>Populus tremuloides</i>	<i>Salix Bebbiana</i>
<i>Populus balsamifera</i> **	<i>Betula papyrifera</i> **

Shrubs

<i>Juniperus sibirica</i> (Eur.)	<i>Lepargyrea canadensis</i>
<i>Dasiphora fruticosa</i> (Eur.)	<i>Arctostaphylos Uva-ursi</i> (Eur.)
<i>Chamaepericlymenum</i>	<i>Linnaea americana</i>
<i>candense</i>	<i>Distegia involucrata</i>

*Flora of The Rocky Mountains and Adjacent Plains. New York. 1917.

Herbs

<i>Phleum alpinum</i> (Eur.)	<i>Ramischia secunda</i> (Eur.)
<i>Avena striata</i>	<i>Monotropa uniflora</i>
<i>Danthonia spicata</i>	<i>Veronica serpyllifolia</i> (Eur.)
<i>Poa compressa</i> (Eur.)	<i>Galium boreale</i> (Eur.)
<i>Allium sibiricum</i> (Asia)	<i>Galium triflorum</i>
<i>Lysiella obtusata</i>	<i>Specularia perfoliata</i>
<i>Peramium decipiens</i>	<i>Botrychium Lunaria</i> (Eur.)
<i>Cytherea bulbosa</i> (Eur.)	<i>Botrychium virginianum</i> (Eur.)
<i>Corallorrhiza multiflora</i>	<i>Botrychium silaifolium**</i>
<i>Tium alpinum</i> (Eur.)	<i>Filix bulbifera</i>
<i>Chamaenerium spicatum</i> (Eur.)	<i>Filix fragilis</i> (Eur.)
<i>Heracleum lanatum</i>	<i>Filix montana</i> (Eur.)
<i>Moneses uniflora</i> (Eur.)	<i>Polystichum Lonchitis</i>
<i>Pyrola uliginosa</i>	<i>Thelypteris Dryopteris</i> (Eur.)
<i>Pyrola asarifolia**</i>	<i>Asplenium septentrionale</i> (Eur.)
<i>Pyrola chlorantha</i> (Eur.)	<i>Asplenium Trichomanes</i> (Eur.)
<i>Pyrola elliptica</i>	<i>Pteris aquilina</i> (Eur.)
<i>Erxlebenia minor</i> (Eur.)	<i>Cryptogramma acrostichoides</i>

b. Aquatic and bog species

The following water and bog plants probably reached the Rockies by the way of the Northern Woods:

Shrubs

<i>Salix chlorophylla</i>	<i>Betula glandulosa</i>
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Herbs

<i>Sparganium minimum</i> (Eur.)	<i>Scirpus caespitosus</i> (Eur.)
<i>Triglochin palustris</i> (Eur.)	<i>Carex diandra</i> (Eur.)†
<i>Calamagrostis Langsdorfii</i> (Eur.)	<i>Carex gynocrates</i> (Eur.)
<i>Deschampsia caespitosa</i>	<i>Carex disperma</i> (Eur.)
<i>Catabrosa aquatica</i> (Eur.)	<i>Carex canescens</i> (Eur.)
<i>Panicularia nervata</i>	<i>Carex brunnescens</i> (Eur.)
<i>Panicularia borealis</i>	<i>Carex paupercula</i> (Eur.)
<i>Panicularia septentrionalis</i>	<i>Carex aquatilis</i> (Eur.)
<i>Eriophorum angustifolium</i> (Eur.)	<i>Bistorta vivipara</i> (Eur.)†
<i>Scirpus pauciflorus</i> (Eur.)	<i>Alsine borealis</i>

<i>Sagina saginoides</i> (Eur.)	<i>Mimulus moschatus</i>
<i>Thalictrum alpinum</i> (Eur.)†	<i>Limosella aquatica</i> (Eur.)
<i>Batrachium flaccidum</i> (Eur.)	<i>Limosella tenuifolia</i> (Eur.)
<i>Ranunculus reptans</i>	<i>Veronica Wormskjoldii</i> †
<i>Cardamine pennsylvanica</i>	<i>Elephantella groenlandica</i>
<i>Subularia aquatica</i> (Eur.)	<i>Senecio pauciflorus</i>
<i>Epilobium alpinum</i> (Eur.)†	<i>Lycopodium annotinum</i> (Eur.)
<i>Epilobium Hornemannii</i> (Eur.)†	

c. Various mesophytes

A few plants which are neither aquatics nor forest species have invaded the Rockies from the north. These are species that grow among bushes, among rocks, or on hillsides.

<i>Torresia odorata</i> (Eur.)	<i>Juncoides parviflorum</i> (Eur.)
<i>Calamagrostis purpurascens</i>	<i>Juncoides intermedium</i>
<i>Poa crocata</i>	<i>Juncoides spicatum</i> (Eur.)†
<i>Festuca rubra</i> (Eur.)	<i>Blitum capitatum</i> (Eur.)
<i>Bromus ciliatus</i>	<i>Moehringia latifolia</i> (Eur.)
<i>Carex praticola</i>	<i>Moehringia macrophylla</i>
<i>Carex concinna</i>	<i>Viola adunca</i>
<i>Carex Halleri</i> (Eur.)	

2. PLANTS WITH RIPARIAN OR CAMPESTRIAN DISTRIBUTION

These plants have crossed the continent over the plains, following mostly the watercourses. All of them are found in the foothills also and most of them attain their best development on the plains and prairies.

a. Aquatic plants

<i>Sparganium angustifolium</i> †	<i>Panicularia grandis</i> †
<i>Potamogeton natans</i> (Eur.)†	<i>Eleocharis palustris</i> (Eur.)†
<i>Potamogeton alpinus</i> (Eur.)†	<i>Eleocharis acicularis</i> (Eur.)†
<i>Potamogeton lucens</i> (Eur.)†	<i>Eriophorum gracile</i> (Eur.)†
<i>Potamogeton foliosus</i> †	<i>Scirpus validus</i> †
<i>Triglochin maritima</i> (Eur.)	<i>Lemna trisulca</i> (Eur.)†
<i>Alisma brevipes</i>	<i>Lemna minor</i> (Eur.)†
<i>Sagittaria latifolia</i> †	<i>Persicaria coccinea</i> †
<i>Phragmites Phragmites</i> (Eur.)†	<i>Batrachium trichophyllum</i> (Eur.)†

<i>Batrachium Drouetii</i> (Eur.)‡	<i>Hippuris vulgaris</i> (Eur.)‡
<i>Ranunculus Purshii</i> ‡	<i>Sium cicutaeifolium</i> ‡
<i>Sisymbrium Nasturtium-aquaticum</i> (Eur.)‡	<i>Menyanthes trifoliata</i> (Eur.)‡
	<i>Veronica americana</i> ‡
<i>Tillaeastrum aquaticum</i> (Eur.)‡	<i>Utricularia vulgaris</i> (Eur.)‡
<i>Callitriche palustris</i> (Eur.)‡	<i>Utricularia minor</i> (Eur.)‡
<i>Callitriche autumnalis</i> (Eur.)‡	

b. Bog and wet meadow plants

Tree

Salix cordata

Herbs

<i>Phalaris arundinacea</i> (Eur.)‡	<i>Carex rostrata</i> ‡
<i>Alopecurus aristulatus</i> ‡	<i>Carex retrorsa</i> ‡
<i>Calamagrostis elongata</i> ‡	<i>Rumex occidentalis</i>
<i>Calamagrostis canadensis</i> ‡	<i>Rumex mexicanus</i>
<i>Beckmannia erucaeformis</i> ‡	<i>Ranunculus sceleratus</i> (Eur.)
<i>Carex leptalea</i> (Eur.)	<i>Halerpestes Cymbalaria</i> ‡
<i>Carex aurea</i> ‡	<i>Argentina Anserina</i> (Eur.)‡
<i>Carex Buxbaumii</i> (Eur.)‡	<i>Gnaphalium uliginosum</i> (Eur.)
<i>Carex lanuginosa</i>	<i>Equisetum arvense</i> (Eur.)
<i>Carex viridula</i> ‡	

c. Meadow plants

<i>Agrostis hyemalis</i> ‡	<i>Juncus bufonius</i> (Eur.)‡
<i>Muhlenbergia Richardsonis</i>	<i>Polygonum ramosissimum</i> ‡
<i>Poa annua</i> (Eur.)‡	<i>Capnodes aureum</i> ‡
<i>Poa triflora</i> (Eur.)‡	<i>Arabis ovata</i> ‡
<i>Poa pratensis</i> (Eur.)‡	<i>Draba nemorosa</i> ‡
<i>Festuca octoflora</i> ‡	<i>Viola nephrophylla</i> ‡
<i>Hordeum jubatum</i> ‡	<i>Viola septentrionalis</i> ‡
<i>Carex stenophylla</i> ‡	<i>Artemisia biennis</i>
<i>Carex interior</i>	

To this category belong also some of the escaped cultivated plants and common weeds, such as

<i>Phleum pratense</i> (Eur.)‡	<i>Bursa Bursa-pastoris</i> (Eur.)‡
<i>Dactylis glomerata</i> (Eur.)‡	<i>Carum Carui</i> (Eur.)‡
<i>Syntherisma Ischaemum</i> (Eur.)	<i>Plantago major</i> (Eur.)‡
<i>Chenopodium Botrys</i> (Eur.)‡	

d. Hillside plants

<i>Panicum Huachucae</i>	<i>Bilderdykia Convolvulus</i> (Eur.)
<i>Ibidium strictum</i>	<i>Pulsatilla ludoviciana</i>
<i>Polygonum Douglasii</i>	

B. TRANSCONTINENTAL SPECIES RESTRICTED TO THE NORTHERN ROCKIES

Nearly all of the transcontinental plants restricted in their distribution to the Northern Rockies are of boreal-sylvan distribution, whether they are forest species or not. In spreading across the continent, they have followed the northern woods around the plains north of the Saskatchewan and then south in the mountains. In some cases the species have not extended very far south—have not even entered the United States; in other words, their distribution in the Rockies is limited to District 1, the Canadian Rockies. Others have traveled farther south and invaded District 2, or even Districts 3 and 4. About one third have spread further south into District 5 and from there to Districts 6, 7 and 8. Two are even found in the Uintah-Wasatch District of the Southern Rockies.

I. SPECIES REACHING AT LEAST THE YELLOWSTONE DISTRICT

a. Forest plants

<i>Sabina horizontalis</i>	<i>Androsace septentrionalis</i> (Eur.)
<i>Melica Smithii</i>	<i>Valeriana septentrionalis</i>
<i>Oryzopsis pungens</i>	<i>Aster major</i>
<i>Carex Peckii</i>	<i>Aster Lindleyanus</i>
<i>Streptopus amplexifolius</i>	<i>Youngia nana</i> (Asia)†
<i>Rosa acicularis</i> (Asia)	<i>Aspidium viride</i> (Eur.)
<i>Osmorrhiza divaricata</i>	

b. Water and bog plants

<i>Eriophorum Scheuchzeri</i> (Eur.)†	<i>Comarum palustre</i> (Eur.)
<i>Eriophorum Chamissonis</i> (Eur.)†	<i>Equisetum palustre</i> (Eur.)
<i>Carex livida</i>	<i>Equisetum fluviatile</i>
<i>Juncus Richardsonianus</i>	<i>Equisetum laevigatum</i>

c. Cliff plant

Antiphylla oppositifolia (Eur.)†

Of these species *Oryzopsis pungens*, *Carex Peckii*, *Osmorrhiza divaricata* and *Juncus Richardsonianus* have extended their range into the Black Hills of South Dakota, and *Osmorrhiza divaricata* and *Youngia nana* into the Uintah Mountains of Utah.

2. SPECIES REACHING THE MAIN RANGE IN MONTANA OR THE
BITTER-ROOTS IN IDAHO, BUT NOT FURTHER SOUTH

a. Forest plants

<i>Actaea rubra</i>	<i>Lycopodium obscurum</i> (Eur.)
<i>Ribes Hudsonianum</i>	<i>Lycopodium complanatum</i> (Eur.)
<i>Dryopteris Filix-mas</i> (Eur.)	<i>Lycopodium clavatum</i> (Eur.)
<i>Dryopteris dilatata</i> (Eur.)	<i>Lycopodium sitchense</i>

b. Water and bog plants

Shrubs

<i>Salix pedicellaris</i>	<i>Salix candida</i>
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Herbs

<i>Rhynchospora alba</i> (Eur.)	<i>Castalia Leibergii</i>
<i>Scirpus subterminalis</i>	<i>Drosera rotundifolia</i> (Eur.)
<i>Scirpus atrocinctus</i>	<i>Drosera longifolia</i> (Eur.)
<i>Carex vaginata</i> (Eur.)	<i>Geum macrophyllum</i>
<i>Carex limosa</i> (Eur.)	<i>Mertensia paniculata</i>
<i>Carex scirpoidea</i> (Eur.)	<i>Equisetum sylvaticum</i> (Eur.)
<i>Carex lacustris</i> (Eur.)	<i>Equisetum scirpoides</i> (Eur.)
<i>Carex Crawfordii</i>	<i>Lycopodium inundatum</i> (Eur.)
<i>Carex flava</i> (Eur.)	

Pellaea glabella, growing among exposed rocks, has a peculiar distribution. Though it is not found in the Southern Rockies it is found in the Black Hills and the hilly country of western Nebraska and reappears in eastern Kansas.

3. SPECIES LIMITED TO THE CANADIAN ROCKIES

a. Forest species

<i>Carex aenea</i>	<i>Coptis trifoliata</i> (Eur.)
<i>Carex durifolia</i>	<i>Thelypteris Phegopteris</i> (Eur.)
<i>Cypripedium passerinum</i>	<i>Dryopteris fragrans</i> (Eur.)
<i>Lysias orbiculata</i>	<i>Woodsia glabella</i> (Eur.)
<i>Ophrys convallarioides</i>	<i>Lycopodium alpinum</i> (Eur.)
<i>Comandra livida</i>	

b. Water and bog plants

Herbs

<i>Eriophorum callitrix</i> (Eur.)	<i>Carex militaris</i>
<i>Eriophorum opacum</i> (Eur.)	<i>Carex deflexa</i>
<i>Scirpus pumilus</i> †	<i>Oxycoccus Oxycoccus</i> (Eur.)
<i>Carex chordorrhiza</i>	<i>Oxycoccus macrocarpus</i>

II. Species common to the Rockies and the Canadian Zone

The plants common to the Rockies and to the Canadian Zone of the East consist either of eastern species, whose ranges extend west into the Rockies, or of Rocky Mountain species which have invaded the East. The distribution of the former in the Rockies is very similar to that of the transcontinental species just treated. Some of them have followed the northern woods, others the watercourses across the plains. The distribution area of some reaches the Southern Rockies, while that of others stops in northern Wyoming, in northern Montana, or in the Canadian Rockies. Among the Rocky Mountain species which have emigrated east, some have reached the Lake Superior region, while others are found as far east as the Gaspé Peninsula of Quebec.

A. EASTERN SPECIES, EXTENDING SOUTH INTO THE SOUTHERN ROCKIES

I. Plants of boreal-sylvan distribution

a. Forest species

<i>Oryzopsis asperifolia</i>	<i>Vagnera stellata</i>
<i>Agrostis oreophila</i>	<i>Coeloglossum bracteatum</i>
<i>Cinna latifolia</i> (Eur.)	<i>Peramium ophoides</i>
<i>Carex Parryana</i> †	<i>Corallorrhiza Corallorrhiza</i> (Eur.)

<i>Claytonia virginica</i>	<i>Prunella vulgaris</i> (Eur.)
<i>Ranunculus micranthus</i>	<i>Clinopodium vulgare</i> (Eur.)
<i>Fragaria americana</i>	<i>Pedicularis canadensis</i>
<i>Rubus pubescens</i>	<i>Linnaea americana</i>
<i>Viola Selkirkii</i>	<i>Erigeron droebachiensis</i> (Eur.)
<i>Viola renifolia</i>	<i>Botrychium simplex</i> (Eur.)
<i>Viola canadensis</i>	<i>Botrychium neglectum</i> (Eur.)
<i>Circaea alpina</i> (Eur.)	<i>Cryptogramma Stelleri</i>
<i>Aralia nudicaulis</i>	<i>Selaginella selaginoides</i>

b. Water and bog plants

<i>Alsine alpestris</i> (Eur.)	<i>Epilobium adenocaulon</i>
<i>Alsine crassifolia</i>	<i>Petasites sagittata</i>
<i>Parnassia parviflora</i>	<i>Nabalus racemosa</i>
<i>Geum rivale</i> (Eur.)	<i>Lactuca spicata</i>
<i>Viola palustris</i> (Eur.)	<i>Equisetum pratense</i> (Eur.)

2. EASTERN PLANTS WITH RIPARIAN OR CAMPESTRIAN DISTRIBUTION

<i>Muhlenbergia racemosa</i>	<i>Sullivantia Hapemanii</i>
<i>Juncus Vaseyi</i>	<i>Vicia trifida</i>
<i>Carex lanuginosa</i>	<i>Vicia americana</i>
<i>Urtica gracilis</i>	<i>Apocynum androsaemifolium</i>
<i>Carex siccata</i>	<i>Macrocalyx Nyctelea</i> †
<i>Thalictrum dasycarpum</i>	<i>Plantago eriopoda</i> †
<i>Lepidium densiflorum</i> †	<i>Rudbeckia hirta</i>

Vitis riparia, *Juncus Torreyi*, and *Asplenium platyneuron*, eastern species, have reached the Southern Rockies in Colorado, but are not found in the Northern.

3. PLANTS OF THE GREAT PLAINS

Some of the plants of the Great Plains extend up into the Montane Zone. Although they do not belong to the Canadian or Alleghanian Zones of the eastern United States, they are immigrants from the East and may be included here.

<i>Calamagrostis micrantha</i>	<i>Plantago Purshii</i>
<i>Polygonum buxiforme</i>	<i>Laciniaria punctata</i>
<i>Xanthoxalis Bushii</i>	<i>Chrysopsis villosa</i>
<i>Viola pedatifida</i>	<i>Solidago glaberrima</i>
<i>Anogra latifolia</i>	<i>Equisetum variegatum</i>
<i>Anogra coronopifolia</i>	

B. EASTERN SPECIES, EXTENDING INTO THE NORTHERN ROCKIES
ONLY

I. SPECIES REACHING AT LEAST THE YELLOWSTONE REGION

<i>Carex Richardsonii</i>	<i>Phaca americana</i>
<i>Carex eburnea</i>	<i>Hedysarum americanum</i>
<i>Heuchera hispida</i>	

Of these, *Heuchera hispida* and *Phaca americana* even reach the Black Hills and western Nebraska.

2. SPECIES EXTENDING ONLY TO NORTHERN MONTANA OR IDAHO

<i>Carex tenera</i>	<i>Chiogenes hispidula</i>
<i>Carex pedunculata</i>	<i>Melampyrum lineare</i>
<i>Parnassia palustris</i> (Eur.)	<i>Thelypteris Robertiana</i> (Eur.)
<i>Mitella nuda</i>	<i>Dryopteris cristata</i> (Eur.)

3. SPECIES LIMITED TO THE CANADIAN ROCKIES

Trees

<i>Picea canadensis</i>	<i>Picea mariana</i>
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Shrub

Salix pellita

Herbs

<i>Carex atratiformis</i>	<i>Primula mistassinica</i>
<i>Vagnera trifoliata</i>	<i>Petasites palmata</i>
<i>Coptidium lapponicum</i> (Eur.)	<i>Pteretis nodulosa</i>
<i>Ribes glandulosum</i>	<i>Dryopteris intermedia</i>
<i>Geum perincisum</i>	

Of these, *Picea canadensis* and *Pteretis nodulosa* are found also in the Black Hills.

C. ROCKY MOUNTAIN SPECIES WHICH HAVE EMIGRATED EAST-
WARD

The following plants have extended their ranges as far east as eastern Minnesota, western Ontario, upper Michigan or Hudson Bay.

Shrubs

<i>Rosa Bourgeauiana</i>	<i>Amelanchier alnifolia</i>
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Herbs

<i>Viola rugulosa</i>	<i>Aster Wilsonii</i>
<i>Monarda menthaefolia</i>	<i>Solidago pulcherrima</i>
<i>Androsace subumbellata</i>	<i>Erigeron glabellus</i>
<i>Aster laevis</i>	

Another species, *Dryas Drummondii*, has even reached the Gaspé Peninsula, Quebec.

III. Species common to the Rockies and the Pacific Mountains

A. SPECIES FOUND IN BOTH THE NORTHERN AND SOUTHERN ROCKIES, AS WELL AS THE CASCADES AND THE SIERRAS

a. Forest species

Nearly all of the plants belonging in this category have passed from the Rockies to the Pacific Mountains, or vice versa, in the north where the two mountain systems are connected, and not across the Great Basin.

Trees

<i>Pseudotsuga mucronata</i>	<i>Apinus flexilis</i>
<i>Pinus Murrayana</i>	<i>Salix Scouleriana</i>

Shrubs

<i>Odostemon Aquifolium</i>	<i>Pachystima Myrsinites</i>
<i>Ribes viscosissimum</i>	<i>Gaultheria humifusa</i>
<i>Rubacer parviflorum</i>	<i>Vaccinium scoparium</i>
<i>Echinopanax horridum</i>	

Herbs

<i>Oryzopsis Bloomeri</i>	<i>Ranunculus Douglasii</i>
<i>Festuca subulata</i>	<i>Ranunculus Bongardii</i>
<i>Elymus glaucus</i>	<i>Actaea arguta</i>
<i>Carex Bolanderi</i>	<i>Thalictrum sparsiflorum</i>
<i>Carex athrostachya</i>	<i>Aquilegia coerulea</i>
<i>Veratrum speciosum</i>	<i>Osmorrhiza obtusa</i>
<i>Vagnera amplexicaulis</i>	<i>Pectianthia pentandra</i>
<i>Vagnera lilacina</i>	<i>Fragaria bracteata</i>
<i>Trillium ovatum</i>	<i>Geranium viscosissimum</i>
<i>Piperia unalaschensis</i>	<i>Geranium Richardsonii</i>

<i>Linum Lewisii</i>	<i>Achillea lanulosa</i>
<i>Circaea pacifica</i> *	<i>Artemisia frigida</i> (Asia)
<i>Glycosma occidentalis</i>	<i>Arnica cordifolia</i>
<i>Chimaphila occidentalis</i>	<i>Senecio pseud aureus</i>
<i>Pyrola picta</i>	<i>Hieracium albiflorum</i>
<i>Pterospora Andromedea</i>	<i>Athyrium alpestre</i> (Eur.)
<i>Androsace filiformis</i> (Asia)	<i>Athyrium cyclosorum</i> (Eur.)
<i>Polemonium occidentale</i>	<i>Cryptogramma densa</i>
<i>Collinsia parviflora</i>	<i>Polypodium hesperium</i>
<i>Pedicularis racemosa</i>	

Cryptogramma densa, *Athyrium alpestre*, and *Osmorrhiza obtusa* reappear eastward on the Gaspé Peninsula, Quebec. When their distribution in Canada becomes better known, they may prove to belong among the transcontinental plants. *Thalictrum sparsiflorum* extends east to the Hudson Bay, *Elymus glaucus* to Upper Michigan, and *Collinsia parviflora* and *Achillea lanulosa* to western Ontario; *Echinopanax horridum* is found near the shores of Lake Superior.

b. Water and bog plants

In this class have also been included many plants of the wetter meadows and copses; in other words, the class consists of plants which probably have spread along the watercourses. This means, in this case, mostly along the Columbia River and its tributaries, for the Frazer River drains mostly the Cascades and other ranges west of the Rockies. Only the headwaters of this stream are in the Rocky Mountains, though north of the region here considered and mainly within the Subarctic Zone. The Colorado of the West runs for hundreds of miles in a deep canyon, does not touch the Sierras, and therefore can play practically no part in the distribution of the Montane plants.

Shrubs

<i>Salix glaucops</i>	<i>Kalmia microphylla</i>
<i>Alnus tenuifolia</i>	

Herbs

<i>Muhlenbergia comata</i> ‡	<i>Agrostis grandis</i>
<i>Muhlenbergia filiformis</i>	<i>Agrostis asperifolia</i> ‡

<i>Agrostis variabilis</i>	<i>Ranunculus Eschscholtzii</i>
<i>Grapphephorum Brandegei</i>	<i>Campe americana</i> ‡
<i>Danthonia californica</i>	<i>Parnassia fimbriata</i>
<i>Danthonia unispicata</i>	<i>Micranthes arguta</i>
<i>Carex Reynoldsii</i>	<i>Geum oregonense</i>
<i>Carex tenuirostris</i>	<i>Vicia oregana</i> ‡
<i>Carex simulata</i>	<i>Vicia sparsiflora</i> ‡
<i>Carex athrostachya</i>	<i>Epilobium brevistylum</i>
<i>Carex Kelloggii</i>	<i>Epilobium occidentale</i>
<i>Lemna gibba</i> (Eur.)	<i>Amarella strictiflora</i>
<i>Juncus Mertensianus</i>	<i>Mimulus Langsdorffii</i>
<i>Iris missouriensis</i>	<i>Mimulus Lewisii</i> ‡
<i>Polygonum Watsonii</i>	<i>Pedicularis bracteosa</i>
<i>Bistorta bistortoides</i> †	<i>Galium subbiflorum</i>
<i>Claytonia lanceolata</i>	<i>Aster occidentalis</i>
<i>Crunocallis Chamissonis</i>	<i>Aster Burkei</i>
<i>Alsine strictiflora</i>	<i>Erigeron salsuginosus</i>
<i>Alsine laeta</i> †	<i>Rudbeckia occidentalis</i>
<i>Alsine calycantha</i>	<i>Senecio triangularis</i>
<i>Nymphaea polysepala</i>	<i>Arnica longifolia</i>
<i>Thalictrum sparsiflorum</i> (Asia)	<i>Agoseris elata</i>
<i>Myosurus aristatus</i>	

Of these, some have spread also to the East, as *Crunocallis Chamissonis* and *Galium subbiflorum* to Minnesota, *Linum Lewisii* to the Black Hills and Nebraska, *Alsine strictiflora* to Ontario, and *Thalictrum sparsiflorum* and *Alsine laeta* to Hudson Bay.

c. Various mesophytes

In this category are included plants that grow in open places, as dry meadows, table-land, hillsides and cliffs. Many of these grow also at lower altitudes; in the foothills and even on the plains. Many are also common to the mountain chains of the Great Basin.

Trees or shrubs

<i>Cercocarpus ledifolius</i>	<i>Limnobotrya montigena</i>
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Herbs

<i>Eriocoma hymenoides</i> ‡	<i>Viola venosa</i>
<i>Poa longiligula</i>	<i>Viola linguaeifolia</i>
<i>Poa Sandbergii</i>	<i>Epilobium paniculatum</i> ‡
<i>Hesperochloa Kingii</i> ‡	<i>Gayophytum intermedium</i>
<i>Agropyron Smithii</i> ‡	<i>Gayophytum ramosissimum</i>
<i>Elymus condensatus</i> ‡	<i>Gayophytum racemosum</i>
<i>Carex Douglasii</i> ‡	<i>Oenothera Hookeri</i>
<i>Carex Hoodii</i>	<i>Lavauxia flava</i>
<i>Carex phaeocephala</i> †	<i>Leptodactylon pungens</i>
<i>Carex obtusata</i> (Eur.)	<i>Leptodactylon Nutallii</i>
<i>Carex Rossii</i>	<i>Gilia aggregata</i>
<i>Juncus longistylis</i>	<i>Collomia linearis</i>
<i>Juncoides comosum</i>	<i>Hydrophyllum capitatum</i>
<i>Eriogonum stellatum</i>	<i>Lappula floribunda</i>
<i>Eriogonum umbellatum</i>	<i>Cryptantha Torreyana</i>
<i>Eriogonum ovalifolium</i>	<i>Pentstemon procerus</i>
<i>Polygonum sawatchense</i>	<i>Castilleja linariaefolia</i>
<i>Sarcobatus vermiculatus</i> ‡	<i>Campanula petiolata</i>
<i>Eurotia lanata</i> ‡	<i>Macronema suffruticosum</i>
<i>Lewisia redeviva</i>	<i>Aster campestris</i>
<i>Oreobroma pygmaea</i>	<i>Antennaria rosea</i>
<i>Cerastium strictum</i> (Eur.)	<i>Antennaria oblanceolata</i>
<i>Arenaria congesta</i> †	<i>Gymnolomia multiflora</i> ‡
<i>Arenaria Burkei</i> ‡	<i>Balsamorhiza sagittata</i>
<i>Anemone globosa</i>	<i>Wyethia amplexicaulis</i>
<i>Draba lutea</i> (Eur.)	<i>Helianthus petiolaris</i> ‡
<i>Arabis retrofracta</i>	<i>Madia glomerata</i>
<i>Sedum stenosepalum</i>	<i>Chaenactis Douglasii</i>
<i>Lithophragma bulbifera</i>	<i>Artemisia incompta</i>
<i>Lithophragma parviflora</i>	<i>Artemisia tridentata</i> ‡
<i>Petrophytum caespitosum</i>	<i>Arnica pedunculata</i>
<i>Potentilla Bakeri</i>	<i>Arnica fulgens</i>
<i>Potentilla diversifolia</i>	<i>Agoseris laciniata</i>
<i>Drymocallis glandulosa</i>	<i>Woodsia oregana</i>
<i>Lupinus tenellus</i>	<i>Woodsia scopulina</i>
<i>Lupinus argenteus</i> ‡	

Of these *Eriocoma hymenoides*, *Juncus longistylis*, *Arabis retrofracta*, *Lithophragma bulbifera*, *L. parviflora*, *Petrophytum caespitosum*, *Drymocallis glandulosa*, *Epilobium paniculatum*, *Arnica pedunculata*, and *A. fulgens* extend as far east as South Dakota and Nebraska; *Gilia aggregata* extends to Minnesota, reappearing farther east on the Gaspé Peninsula; *Carex Rossii* and *Draba lutea* to upper Michigan; *Woodsia scopulina* and *W. oregana* are found on the Gaspé Peninsula.

B. ROCKY MOUNTAIN SPECIES FOUND IN BOTH SOUTHERN AND NORTHERN ROCKIES, WHICH HAVE SPREAD INTO THE CASCADES, BUT ARE NOT FOUND IN SIERRA NEVADA

a. Forest species

Tree

Picea Engelmannii

Shrubs

Sorbus scopulina

Rubus melanolasius

Herbs

Calamagrostis luxurians

Conioselinum scopulorum

Carex Geyeri

Ligusticum tenuifolium

Ophrys nephrophylla

Apocynum ambigenum

Razoumofskia americana

Aster Geyeri

Razoumofskia Douglasii

Erigeron macranthus

Astragalus columbianus

Erigeron speciosus

Ozomelis stauropetala

Erigeron conspicuus

b. Water and bog plants

Shrub

Salix exigua

Herbs

Poa leptocoma

Alsine obtusa

Poa interior

Ranunculus alismaefolius

Poa Olneyæ

Ranunculus cardiophyllus†

Agrostis humilis

Trollius albiflorus

Agrostis idahoensis

Delphinium multiflorum

Limnorchis stricta

Argentina argentea

Limnorchis borealis

Dodecatheon parviflorum

Limnorchis viridiflora

Castilleja exilis

Ibidium porrifolium

Graphalium sulphureum

Of these *Argentina argentea* extends east to South Dakota and *Ranunculus cardiophyllus* to eastern Saskatchewan.

c. Various mesophytes

<i>Melica spectabilis</i>	<i>Viola vallicola</i>
<i>Melica bella</i>	<i>Phlox caespitosa</i>
<i>Bromus polyanthus</i>	<i>Gilia pulchella</i>
<i>Carex nubicola</i>	<i>Phacelia sericea</i>
<i>Carex pachystachya</i>	<i>Castilleja lancifolia</i>
<i>Carex Geyeri</i>	<i>Castilleja lauta</i>
<i>Carex filifolia</i> ‡	<i>Castilleja hispida</i>
<i>Carex scopulorum</i>	<i>Orthocarpus luteus</i>
<i>Anticlea elegans</i>	<i>Coleosanthus grandiflorus</i>
<i>Juncus confusus</i>	<i>Aster apricus</i>
<i>Allium Geyeri</i>	<i>Antennaria flavescens</i>
<i>Delphinium Nelsonii</i>	<i>Antennaria concinna</i>
<i>Thlaspi Nuttallii</i>	<i>Antennaria corymbosa</i>
<i>Draba nitida</i>	<i>Antennaria pulcherrima</i>
<i>Peritoma serrulatum</i>	<i>Antennaria anaphaloides</i>
<i>Leptasea austromontana</i>	<i>Artemisia Michauxiana</i>
<i>Potentilla Nuttallii</i>	<i>Artemisia cana</i> ‡
<i>Drymocallis corymbosa</i>	<i>Artemisia arbuscula</i>
<i>Sieversia grisea</i>	<i>Artemisia tripartita</i>
<i>Sieversia ciliata</i>	<i>Arnica Parryi</i>
<i>Thermopsis montana</i>	<i>Arnica mollis</i>
<i>Lupinus caespitosus</i>	<i>Arnica Rydbergii</i>
<i>Astragalus striatus</i>	<i>Senecio serra</i>
<i>Astragalus goniatus</i>	<i>Selaginella densa</i>

Of these, *Delphinium Nelsonii*, *Anticlea elegans*, *Juncus confusus*, and *Allium Geyeri* extend east to South Dakota or Nebraska, *Astragalus striatus* to Minnesota, and *A. goniatus* to Hudson Bay.

c. PACIFIC SPECIES, WHICH HAVE INVADED THE NORTHERN
ROCKIES, BUT NOT THE SOUTHERN

I. SPECIES WHICH HAVE REACHED ONLY THE SELKIRK-BITTERROOT
DISTRICT

a. Forest species

The species listed here have probably followed the mountain chains in their migration from the Pacific Mountains by the way of the Cascades and the Selkirks into the Rockies.

Trees

Strobilus monticola

Larix occidentalis

Abies grandis

Tsuga heterophylla

Thuja plicata

Taxus brevifolia

Shrubs

Ribes nevadense

Rubus nivalis

Rubus spectabilis

Ceanothus prostratus

Azaliastrum albiflorum

Vaccinium parvifolium

Linnaea longiflora

Herbs

Carex laeviculmis

Unifolium dilatatum

Allium validum

Disporum oreganum

Clintonia uniflora

Piperia multiflora

Piperia elegans

Lysias Menziesii

Eburophyton Austiniae

Cytherea occidentalis

Corallorrhiza Mertensiana

Trautvetteria grandis

Mitellastra caulescens

Pectianthia Breweri

Therophon majus

Chimaphila Menziesii

Castilleja pinetorum

b. Water and bog plants

These have probably followed the Columbia River and Frazer River and their tributaries up into the mountains.

Shrubs or trees

Salix Lemmonii

Salix sitchensis

Herbs

<i>Agrostis foliosa</i>	<i>Dodecatheon Jeffreyi</i>
<i>Calamagrostis Cusickii</i>	<i>Anthopogon simplex</i>
<i>Grapphephorum muticum</i>	<i>Mimulus nasutus</i>
<i>Tofieldia occidentalis</i>	<i>Mimulus primuloides</i>
<i>Cardamine oligosperma</i>	<i>Mimulus Breweri</i>
<i>Lupinus polyphyllus</i>	<i>Polystichum munitum</i>
<i>Trifolium longipes</i>	<i>Isoetes Howellii</i>
<i>Epilobum oregonense</i>	<i>Isoetes Nuttallii</i>
<i>Epilobum glaberrimum</i>	

C. Various mesophytes

These have probably spread along the foothills from the Cascades to the Selkirks and Bitterroots, or even across the Columbia Plains, as most of them are also found in the Submontane or Transition Zone.

Herbs

<i>Stipa Thurberiana</i>	<i>Phoenocaulis cheiranthoides</i>
<i>Festuca viridula</i>	<i>Sedum Douglasii</i>
<i>Hordeum murinum</i> (Eur.)	<i>Heterisia Mertensiana</i>
<i>Carex concinnoides</i>	<i>Dasystephana oregana</i>
<i>Carex spectabilis</i>	<i>Stenotus stenophyllus</i>
<i>Carex Mertensii</i>	<i>Antennaria confinis</i>
<i>Eriogonum pyrolaeifolium</i>	<i>Balsamorhiza deltoidea</i>
<i>Delphinium depauperatum</i>	<i>Arnica Menziesii</i>
<i>Pulsatilla occidentalis</i>	<i>Cheilanthes gracillima</i>
<i>Arabis suffrutescens</i>	<i>Selaginella Wallacei</i>

2. SPECIES WHICH HAVE CROSSED THE MAIN RANGE OF THE ROCKIES IN MONTANA AND ALBERTA

a. Forest species

Trees

<i>Pinus ponderosa</i>	<i>Pinus albicaulis</i>
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Shrubs

<i>Ribes laxiflorum</i>	<i>Acer Douglasii</i>
<i>Rubus pedatus</i>	

Herbs

<i>Melica subulata</i>	<i>Adenocaulon bicolor</i>
<i>Aquilegia formosa</i>	<i>Pyrola dentata</i>
<i>Tiarella unifoliata</i>	

b. Water and bog plants

<i>Poa nervosa</i>	<i>Viola Macloskeyi</i>
<i>Naiocrene parvifolia</i>	<i>Trifolium Beckwithii</i>

c. Various mesophytes

<i>Carex Preslii</i>	<i>Lupinus laxiflorus</i>
<i>Xerophyllum tenax</i>	<i>Phlox Douglasii</i>
<i>Anemone Drummondii</i>	<i>Pedicularis contorta</i>
<i>Smelowskia ovalis</i>	<i>Arnica diversifolia</i>
<i>Arabis Lyallii</i>	

Adenocaulon bicolor reappears on Lake Superior and *Trifolium Beckwithii* in eastern South Dakota.

3. SPECIES WHICH HAVE REACHED THE YELLOWSTONE PARK

a. Forest species

<i>Calamagrostis Suksdorfii</i>	<i>Kelloggia galioides</i>
<i>Hypericum Scouleri</i>	<i>Aster integrifolius</i>
<i>Ozmorrhiza brevipes</i>	<i>Antennaria racemosa</i>

b. Bog plants

Shrub

Salix Austinae

Herbs

<i>Panicum thermale</i>	<i>Alsine crispa</i>
<i>Tofieldia intermedia</i>	<i>Ranunculus alismellus</i>
<i>Juncus nevadensis</i>	<i>Cardamine Breweri</i>

c. Mesophytes

<i>Stipa Elmeri</i>	<i>Potentilla Blaschkeana</i>
<i>Stipa oregonensis</i>	<i>Potentilla glomerata</i>
<i>Calamagrostis rubescens</i>	<i>Fragaria platypetala</i>
<i>Carex Jonesii</i>	<i>Dasystephana calycosa</i>
<i>Carex nervina</i>	<i>Townsendia scapigera</i> †
<i>Carex luzulina</i>	<i>Balsamorhiza terebinthacea</i> †

4. SPECIES WHOSE DISTRIBUTION EXTENDS EVEN INTO THE UTAH
AND WASATCH MOUNTAINS OF UTAH

a. Forest species

Shrubs

Vaccinium occidentale *Sambucus coerulea*

Herbs

Aquilegia flavescens *Apocynum pumilum*
Bicuculla uniflora

b. Water and bog plants

Shrub

Ledum glandulosum

Herbs

Ruppia pectinata *Alsinopsis occidentalis*
Limnia asarifolia *Alsine brachypetala*
Limnia sibirica (Asia) *Dodecatheon alpinum*
Limnia perfoliata *Aster oreganus*

c. Mesophytes

Agrostis Thurberiana *Arabis Lemmonii*
Arenaria Douglasii *Lupinus leucophyllus*
Thalictrum occidentale *Gayophytum diffusum*
Paeonia Brownii *Gayophytum pumilum*
Thlaspi californicum *Lappula diffusa*
Draba oligosperma

D. PLANTS COMMON TO THE NORTHERN ROCKIES AND THE CAS-
CADES, BUT NOT FOUND IN THE SOUTHERN ROCKIES
OR IN SIERRA NEVADA

I. SPECIES FOUND AS FAR SOUTH AS THE YELLOWSTONE PARK
REGION

a. Forest shrubs

Spiraea densiflora *Menziesia ferruginea*
Spiraea lucida *Menziesia glabella*

b. Bog plants

Shrubs

*Salix idahoensis**Alnus sinuata**Salix Geyeriana*

Herbs

*Agrostis oregonensis**Angelica Lyallii**Carex Piperi**Dodecatheon conjugens**Carex microptera**Aster Jessicae**Caltha leptosepala**Senecio subnudus**Lupinus Burkei**Botrychium Coulteri**Epilobium delicatum*

c. Various mesophytes

*Sitanion montanum**Cordylophorum suffruticosum**Elymus nitidus**Amarella anisosepala**Carex Tolmei**Dasystephana monticola**Eriogonum Piperi**Pentstemon crassifolius**Spraguea multiceps**Castilleja pallescens**Silene Lyallii**Valeriana ceratophylla**Silene oregana**Aster conspicuus**Silene multicaulis**Antennaria flagellaris**Thalictrum columbianum**Antennaria Howellii**Delphinium Nuttallianum**Artemisia floccosa**Arabis albertina**Arnica gracilis**Lupinus leucopsis**Senecio Howellii**Lupinus sericeus**Hieracium cynoglossoides*

Lupinus sericeus and *Aster conspicuus* extend east to the Black Hills.

2. SPECIES WHOSE RANGE EXTENDS EVEN INTO THE UTAH-WASATCH REGION

*Juncus Regelii**Potentilla dichroa**Silene columbiana**Castilleja Tweedyi**Ranunculus limosus**Eucephalus elegans**Delphinium bicolor**Hieracium albertinum**Arabis rupestris**Hieracium griseus**Arabis microphylla**Gnaphalium proximum*

3. SPECIES FOUND IN THE MAIN RANGE IN MONTANA AND ALBERTA
BUT NOT FARTHER SOUTH

Shrubs

<i>Salix Fernaldii</i>	<i>Sorbus occidentalis</i>
<i>Philadelphus Lewisii</i>	<i>Vaccinium globulare</i>
<i>Ribes petiolare</i>	<i>Luetkea pectinata</i>
<i>Rosa nutkana</i>	

Herbs

<i>Poa Vaseyochloa</i>	<i>Viola orbiculata</i>
<i>Xerophyllum Douglasii</i>	<i>Valeriana Scouleri</i>
<i>Juncoides glabratum</i>	<i>Penstemon Lyallii</i>
<i>Erythronium grandiflorum</i>	<i>Dodecatheon cylindrocarpum</i>
<i>Eriogonum polyphyllum</i>	<i>Dodecatheon viviparum</i>
<i>Eriogonum depressum</i>	<i>Castilleja Suksdorfii</i>
<i>Arenaria nardifolia</i> (Asia)	<i>Castilleja lutea</i>
<i>Silene repens</i> (Asia)	<i>Antennaria Howellii</i>
<i>Atragene grosseserrata</i>	<i>Antennaria luzuloides</i>
<i>Arabis Nuttallii</i>	<i>Erigeron Howellii</i>
<i>Arabis furcata</i>	<i>Aster modestus</i>
<i>Heuchera glabra</i>	<i>Aster diabolicus</i>
<i>Heuchera grossulariifolia</i>	<i>Aster Sayianus</i>
<i>Micranthes aestivalis</i>	<i>Achillea fusca</i>
<i>Potentilla Drummondii</i>	<i>Cirsium Macounii</i>
<i>Epilobium luteum</i>	<i>Selaginella montanensis</i>

4. CASCADE MOUNTAIN SPECIES WHICH HAVE EMIGRATED INTO THE
SELKIRK-BITTERROOT REGION

Shrub

Salix commutata

Herbs

<i>Alopecurus pallelescens</i>	<i>Eriogonum thymoides</i>
<i>Poa Cusickii</i>	<i>Claytonia chrysantha</i>
<i>Agropyron lanceolatum</i>	<i>Alsine washingtoniana</i>
<i>Elymus Howellii</i>	<i>Arenaria cephaloidea</i>
<i>Carex stenochlaena</i>	<i>Aquilegia columbiana</i>
<i>Allium fibrillum</i>	<i>Sedum Leibergii</i>
<i>Allium Cusickii</i> *	<i>Hemieva ranunculifolia</i>

<i>Aruncus acuminatus</i>	<i>Veronica Cusickii</i>
<i>Trifolium plumosum</i>	<i>Synthyris major</i>
<i>Angelica Piperi</i>	<i>Castilleja cervina</i>
<i>Osmorrhiza Leibergii</i>	<i>Razoumofskya Laricis</i>
<i>Osmorrhiza purpurea</i>	<i>Valeriana sitchensis</i>
<i>Ligusticum Canbyi</i>	<i>Castilleja Vreelandii</i>
<i>Ligusticum Leibergii</i>	<i>Aster Cusickii</i>
<i>Chamaepericlymenum unalas-</i>	<i>Balsamorhiza Careyana</i>
<i>chense</i>	<i>Saussurea americana</i>
<i>Moneses reticulata</i>	<i>Lactuca multifida</i>
<i>Pyrola bracteata</i>	<i>Polystichum Andersoni</i>
<i>Oxycoccus intermedius</i>	<i>Thelypteris Oreopteris</i> (Eur.)
<i>Pentstemon pinetorum</i>	

E. PLANTS COMMON TO THE SOUTHERN ROCKIES AND THE SIERRA NEVADA

These plants have spread across the Great Basin, their seed being carried by birds or wind from mountain to mountain by way of the numerous though low parallel mountain chains within the Basin. Most of them are xerophytic, the rest mesophytic. Species in the following list marked "††" extend into the Submontane Zone; those marked "‡‡" are not found east of the Wasatch Mountains.

Trees

<i>Pinus aristata</i>	<i>Abies concolor</i>
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Herbs

<i>Elymus simplex</i> ††	<i>Erocallis triphylla</i>
<i>Stipa speciosa</i> ‡‡‡‡	<i>Alsine Jamesii</i>
<i>Oryzopsis Webberi</i> ††	<i>Lepidium montanum</i> ††
<i>Muhlenbergia gracilis</i> ††	<i>Heuchera rubescens</i> ‡‡‡†
<i>Poa Fendleriana</i>	<i>Sericotheca glabrescens</i> ‡‡‡†
<i>Carex fissuricola</i> ‡‡	<i>Drymocallis pumila</i> ‡‡
<i>Carex epapillosa</i> ‡‡	<i>Trifolium Rusbyi</i> ‡‡
<i>Rumex hymenosepalus</i> ††	<i>Phaca Hookeriana</i> ‡‡‡†
<i>Amaranthus Powellii</i>	<i>Hamosa calycosa</i> ‡‡‡†
<i>Quamoclidion multiflorum</i> ††	<i>Kentrophyta tegetaria</i> ‡‡
<i>Oreobroma nevadensis</i>	<i>Hypericum formosum</i> ††

<i>Viola Beckwithii</i> ††	<i>Dugaldia Hoopesii</i> ††
<i>Viola Sheltoni</i>	<i>Senecio filicifolius</i> ††††
<i>Microsteris micrantha</i> ††	<i>Polystichum scopulinum</i> ††
<i>Hydrophyllum alpestre</i> ††	<i>Selaginella Watsoni</i> ††
<i>Macronema discoideum</i>	<i>Selaginella Underwoodii</i>

IV. Endemic Rocky Mountain species

As the endemic element of the montane plants is very large, consisting of about 1040 species, or over 53 per cent of the whole number, it is hardly practicable to list them all. I shall therefore merely give the number of species found in each category and mention specifically only a few in each class whose distribution is particularly characteristic or of special interest.

A. ENDEMIC PLANTS COMMON TO THE SOUTHERN AND NORTHERN ROCKIES

Many of the endemic plants are of wide distribution, their range extending from Colorado or northern New Mexico to Montana or even further north. To this category belong the following trees: *Pinus scopulorum*, *Populus angustifolia*, *Betula fontinalis*, and six species of *Salix* (three of these usually mere shrubs). Among the shrubs, *Sambucus melanocarpa*, *Ceanothus velutinus*, and *Sida instolonea* are the most common and most widely distributed. The category contains 6 trees, 12 shrubs, and 217 herbs, and if to these are added 7 grasses and 6 other herbs belonging to the plains and occasionally reaching the Montane Zone, the whole number of species is 248. Of these some extend outside of the Rocky Mountains, as for instance *Sida instolonea*, which reaches to Manitoba and Kansas, *Drymocallis fissa* the Black Hills, and *Scrophularia occidentalis* North Dakota and Oklahoma.

B. PLANTS ENDEMIC TO THE SOUTHERN ROCKIES ONLY

1. PLANTS FOUND BOTH IN THE MAIN RANGE AND IN THE UTAH-WASATCH REGION

To this category belong two trees, *Picea pungens* and *Populus Wislizenii*, together with 13 shrubs and 197 herbs, or in all 212 species. Of these some are limited to the very southern slope of

the Rockies and are in reality immigrants from the Upper Sonoran region, as for instance, *Populus Wislizenii*, *Grossularia leptantha*, *Blepharoneuron tricholepis*, *Calamagrostis scopulorum*, *Festuca arizonica* and *Fragaria ovalis*.

As I have stated elsewhere, the interchange of flora between the Southern Rockies and the Northern does not take place so much along the continental divide in central Wyoming as from the Wasatch Mountains, over the Bear River Mountains and the Tetons, to the Northern Rockies. Several southern species are found in the two intermediate ranges mentioned and several northern ones in the Wasatch. These southern species are as follows:

Shrub

Salix Wolfii

Herbs

Stipa Vaseyi

Primula Parryi

Rumex densiflorus

Orthocarpus purpureo-albus

Ranunculus intertextus

Penstemon subglaber

Delphinium occidentale

Penstemon Rydbergii

Delphinium reticulatum

Aster Canbyi

Cardamine cordifolia

Senecio perplexus

Arabis divaricarpa

Senecio rapifolius

Potentilla filicaulis

Senecio uintahensis

Sidalcea neomexicana

Cirsium Eatoni

Amarella monantha

Leontodon scopulorum

The following plants of the Southern Rockies extend into the Black Hills or western Nebraska.

Poa andina

Ceanothus Fendleri

Eriogonum pauciflorum

Cynomarathrum Nuttallii

Arabis Fendleri

Dodecatheon radiculatum

Draba auriformis

Sambucus microbotrys

Saxifraga simulata

Thelesperma gracilis

Potentilla propinqua

Senecio spartioides

Opulaster monogynus

Senecio rapifolius

2. PLANTS FOUND IN THE MAIN RANGE BUT NOT IN THE UINTAH-WASATCH REGION

To this category belong nearly half of the endemic plants of the Southern Rockies. The list comprises 6 shrubs and 252 herbs, but no trees. Some of these are restricted to the southern slope only and may be considered as immigrants from the Upper Sonoran region. Among these are three of the four fernworts endemic to the Southern Rockies: *Cheilanthes Fendleri*, *Notholaena Fendleri*, and *Selaginella mutica*. A fourth fern, *Woodsia mexicana*, is also found in the Black Hills and in Minnesota, and ranges southward into Mexico.

3. PLANTS RESTRICTED TO THE UINTAH-WASATCH REGION

This category comprises 7 shrubs and 71 herbs, but no trees. Many of these plants are also found in the mountains of the Great Basin. Some of them, as *Fendlerella utahensis*, *Chamaebatiaria Millefolium*, *Arctostaphylos platyphylla*, *Phaca serpens*, and *Phaca Sileriana* are evidently immigrants from the Upper Sonoran region.

There are 47 local endemics found in Wyoming and southeastern Idaho which occur nowhere else in the Rockies. Of these maybe one third should be counted as belonging to the southern Rockies. If so, the total number of endemics restricted to the southern Rockies would be about 560 species.

C. PLANTS ENDEMIC TO THE NORTHERN ROCKIES ONLY

I. PLANTS OF GENERAL DISTRIBUTION WITHIN THE NORTHERN ROCKIES

Fully one-third of the endemic species of the Northern Rockies are of general distribution and extend as far south as the Yellowstone Park Region. Among these are included two trees, *Picea albertiana* and *Betula utahensis*, 4 shrubs and 102 herbs; altogether 108 species. Of these the following extend south into the Uintah-Wasatch region.

Juncus Tweedyi

Cardamine multifolia

Ranunculus saxicola

Delphinium bicolor

Aconitum divaricatum

Draba andina

<i>Arabis oreophila</i>	<i>Swertia congesta</i>
<i>Arabis exilis</i>	<i>Synthyris laciniata</i>
<i>Micranthes Greenei</i>	<i>Orthocarpus Tolmiei</i>
<i>Potentilla ovina</i>	<i>Aster amplifolius</i>
<i>Drymocallis foliosa</i>	<i>Machaeranthera viscosa</i>
<i>Trifolium scariosum</i>	<i>Erigeron tenellum</i>
<i>Angelica Roseana</i>	<i>Arnica arcana</i>
<i>Dodecatheon salinum</i> †	

The following reach the Black Hills:

<i>Alsinopsis dawsonensis</i>	<i>Aragallus gracilis</i>
<i>Atelophragma glabriuscula</i>	<i>Aragallus spicatus</i> †
<i>Atelophragma Forwoodii</i>	<i>Aster meritus</i>
<i>Homalobus dispar</i>	<i>Cirsium Drummondii</i>
<i>Aragallus villosus</i>	

2. SPECIES FOUND IN MONTANA AND NORTHERN IDAHO AND NORTHWARD

This category contains one tree, *Betula subcordata*, two shrubs (*Vaccinium* sp.), and 31 herbs; altogether 34 species. Of these, *Aragallus splendens* extends eastward to Minnesota, *Vaccinium membranaceum* to upper Michigan, and *V. ovalifolium* to the Gaspé Peninsula.

3. LOCAL SPECIES OR SPECIES OF VERY RESTRICTED RANGE

The local species of Wyoming and eastern Idaho number 47 (of which perhaps one third should be accredited to the Southern Rockies while 6 are also found in the Uintahs or Wasatch), those of Montana 19, those of western Idaho 14, those of the Black Hills 5, and those of the Canadian Rockies 22 (among the latter one tree, *Betula alaskana*, and three shrubs); in all, 107 local species. If all categories of endemic species are considered, the number restricted to the Northern Rockies includes altogether about 230 species, and the number endemic to the Rocky Mountains as a whole 1,040 species.

SUMMARY

Within the Montane Zone in the Rocky Mountains are found about 1900 species. Of these, approximately 50 per cent* are

* All percentage figures in the following paragraphs are computed with reference to the total number of species.

Montane plants in the restricted sense, i. e. plants which attain their best development within this zone. Of the rest, many reach their best development in the Subalpine Zone above, and many others in the Submontane Zone below. A few alpine plants are sometimes found as low as the Montane Zone and several species from the Great Plains or from the Sonoran Zone are occasionally found as high up.

Of the plants found in the Montane Zone, 245, or less than 13 per cent, are transcontinental, i. e. they are found both in the East and on the Pacific Slope, as well as in the Rockies; 176 of these, or 9 per cent of the total flora, are common to the Northern and Southern Rockies, another 1 per cent extend as far south as Wyoming, and 1 per cent are limited to the Canadian Rockies.

Besides the transcontinental plants, there are 84 species which are common to the East and the Rockies but have not reached the Pacific Slope. If to these are added a score of western plants which have emigrated eastward as far as the Great Lakes and Hudson Bay, some of them even to the Gaspé Peninsula, Quebec, there are in all about 350 species, or nearly 18½ per cent of the flora, which are common to the East and to the Rockies. The larger portion of these, 250 species or over 13 per cent, are found in both the Northern and Southern Rockies, and 100, or more than 5 per cent, in the Northern only. None of the Montane plants are common to the East and the Southern Rockies only.

The number of species common to the Rockies and the Pacific Mountains is much larger: if the transcontinental species are excluded, about 565, or nearly 30 per cent; or, if these are included nearly 43 per cent of all the plants found within the Montane Zone of the Rockies. Nearly 450 of the plants common to the Rockies and the Pacific Mountains (the transcontinental ones included), or nearly 24 per cent of the whole number are found in both the Northern and Southern Rockies; 350, or about 18 per cent, are found in the Northern Rockies but not in the Southern, and not quite 2 per cent occur in the Southern but not in the Northern Rockies. Of the species common to the Rockies and the Pacific Mountains (the transcontinental ones not included), about 300, or nearly 16 per cent, are found both in the Cascades and the Sierra Nevada; about 225, or nearly 12 per cent, are found in the

Cascades alone, and less than 2 per cent in the Sierra Nevada alone. If the transcontinental plants are added, the percentage for the plants found in both the Sierras and the Cascades and for those found in the Cascades alone would be increased to about 20 per cent of each. The ratio for those found in the Sierras alone would remain less than 2 per cent. This refers of course to the Montane plants only. In the Submontane region the ratio would be much greater.

The endemic element consists of 1,040 Montane plants or over 53 per cent of the whole number. Of these, 245 or nearly 13 per cent are common to the Northern and Southern Rockies, 560 or nearly 29 per cent being restricted to the Southern Rockies, and 230 or 12 per cent to the Northern. Of the latter about 10 per cent extend as far south as Northern Wyoming and 1 per cent are restricted to the Canadian Rockies. Of the species restricted to the Southern Rockies over 11 per cent are common to the Main Range in Wyoming, Colorado, and New Mexico and the Uintah-Wasatch region, while $13\frac{1}{2}$ per cent are restricted to the former and nearly 4 per cent to the latter. Of those restricted to the Northern Rockies, 8 per cent are found in Northern Wyoming and a little over 1 per cent are restricted to the Canadian Rockies. If the flora of the Canadian Rockies were better known this latter number probably would be much larger. We must also remember that only the region south of latitude 55° is here considered.

It may also be of interest to see how the number of species found in the Southern and Northern Rockies would compare, if all categories of Montane plants are taken in consideration. There are over 40 per cent common to both, nearly 28 per cent restricted to the Southern Rockies and 32 per cent to the Northern. The species found in the Southern but not in the Northern Rockies consist almost wholly of endemic forms, less than 2 per cent being common to the Southern Rockies (and most of these found only in Utah) and the Sierra Nevada and 3 species only being Eastern nontranscontinentals. Those found in the Northern Rockies and not in the Southern consist of over 3 per cent transcontinental species, less than 2 per cent being common to the Northern Rockies and the Eastern Canadian Zone, nearly 15 per cent common to the former and the Pacific Mountains and 12 per cent endemics: altogether 32 per cent of all Montane species.

As stated before, the interchange of species between the two great divisions of the Rockies has taken place from the northern part of the Wasatch Mountains over the Bear River Mountains and the Teton Mountains to the Northern Rockies, or vice versa, rather than along the continental divide in central Wyoming. Among the Montane plants, I have listed 69 northern species, or over $3\frac{1}{2}$ per cent of the total flora, which are found in the Wasatch but nowhere else in the Southern Rockies, and 23 Southern species, or over 1 per cent, which are found in southern Idaho or in the Teton Mountains, and nowhere else in the Northern Rockies.

A good deal could also be said about the distribution of the plants in the Black Hills, a meeting place of plants from the Northern Rockies, the Southern Rockies, the Canadian and Alleghanian Zones of the East, and of the flora of the Great Plains, and I hope to take up this subject at some future time.

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